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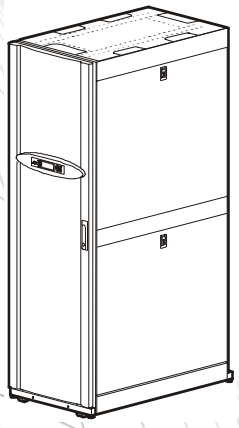
Operation and Maintenance

InRow® RD

ACRD500
ACRD501
ACRD502



This manual is available in English on the enclosed CD.

Dieses Handbuch ist in Deutsch auf der beiliegenden CD-ROM verfügbar.

Deze handleiding staat in het Nederlands op de bijgevoegde cd.

Este manual está disponible en español en el CD-ROM adjunto.

Ce manuel est disponible en français sur le CD-ROM ci-inclus.

Questo manuale è disponibile in italiano nel CD-ROM allegato.

本マニュアルの日本語版は同梱の CD-ROM からご覧になれます。

Instrukcja Obsługi w jezyku polskim jest dostepna na CD.

O manual em Português está disponível no CD-ROM em anexo.

Данное руководство на русском языке имеется на прилагаемом компакт-диске.

您可以从包含的 CD 上获得本手册的中文版本。

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General Information

Overview

Note the definitions for the icons here and be observant for them throughout this manual. They are intended to call attention to potential hazards and important information.

Safety symbols that may be used in this manual

Electrical Hazard: Indicates an electrical hazard which, if not avoided, could result in injury or death.

Danger: Indicates a hazard which, if not avoided, could result in severe personal injury or substantial damage to product or other property.

Warning: Indicates a hazard which, if not avoided, could result in personal injury or damage to product or other property.

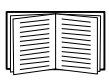
Heavy: Indicates a heavy load that should not be lifted without assistance.

Caution: Indicates a potential hazard which, if not avoided, could result in personal injury or damage to product or other property.

Tip Hazard: This equipment is easily tipped. Use extreme caution when unpacking or moving.

Note: Indicates important information.

Cross-reference symbol used in this manual



See another section of this document or another document for more information on this subject.

Safety

Read and adhere to the following important safety considerations when working with this cooling unit.

Note: All work should be performed by American Power Conversion (APC®) authorized personnel only.

Caution: Keep your hands, clothing, and jewelry away from moving parts. Check the equipment for foreign objects before closing the doors and starting the equipment.

Heavy: The equipment is heavy. For safety purposes, at least two people must be present when moving this equipment.

Tip Hazard: This equipment has a high center-of-gravity. Use extreme caution when moving.

Electrical Hazard: Do not wear jewelry when working near energized components.

Warning: The equipment operates under pressure (2.8–30 bar, 40–435 psig) and is charged with R-407C refrigerant. Take proper safety precautions when servicing the refrigerant loop and read the R-407C Material Safety Data Sheet (MSDS) for safe handling of the refrigerant.

Commissioning

Warning: Procedures in this section must be performed by APC authorized personnel.

Electrical Hazard: Perform Lockout/Tagout procedures on the cooling unit before servicing. Failure to remove power before servicing this equipment could result in serious injury or death.

After installation, verify that all components are working properly and that the equipment is ready to begin operation.

Inspection Checklists

Initial Inspection Checklist

The initial inspection ensures that the equipment has been properly installed.The location of the cooling unit has been properly prepared and the cooling unit is free of damage.

Warning: The cooling unit operates under pressure. Take proper safety precautions when connecting gauges or servicing piping.
Warning: Do not operate the cooling unit with any cover, guard, door, or panel removed unless the instructions indicate otherwise. Then, proceed with extreme caution.
Warning: Do not run service utilities in front of the fan outlets.

Caution: The vapor barrier minimizes moisture infiltration. Without a vapor barrier, it will be difficult to maintain the humidity in the room.
Caution: Do not introduce unconditioned outside air into the space.

Note: A minimum of 900 mm (36 in) of clear floor space in front of and behind the cooling unit is required for service access. To roll the cooling unit out of the row, there must be a minimum of 1200 mm (48 in) of clear floor space in front of or behind the cooling unit. Out of row service requires 760 mm (30 in) of side clearance in addition to the front and rear clearance..

Ensure that:

❑	The installation procedure is complete according to the installation manual.
❑	The walls, floor, and ceiling of the room where the cooling unit is located are sealed with a vapor barrier.
❑	There is no evidence of damage to the cooling unit.
❑	The cooling unit is level and joined to the adjacent racks
❑	The cooling unit is not installed at the open end of a row.
❑	The clearance around the equipment is in accordance with local and national codes and regulations as well as the installation manual.

Electrical Inspection Checklist

The electrical inspection verifies that all electrical connections are secure and correct and that the equipment is properly grounded.

Electrical Hazard: All electrical wiring must comply with local and national codes and regulations.
Electrical Hazard: The equipment must be grounded (do not use a water-pipe ground).
Electrical Hazard: Three-phase electrical service (plus ground) is required.

Ensure that the:

❑	Incoming voltages match the phase and voltage listing on the nameplate.
❑	Electrical wiring complies with local and national codes and regulations.
❑	Equipment is properly grounded.
❑	Front door is properly grounded.
❑	Electrical connections are tight, including contactors, terminal blocks, controllers, switches, relays, auxiliary devices, and field connections.
❑	Circuit breakers are properly connected and securely attached to the DIN rail.

Mechanical Inspection Checklist

The mechanical inspection verifies that all mechanical components and connections are secure and tight and ready for start-up. The inspection ensures that field piping is properly installed to promote oil return to the compressor.

Caution: The equipment is shipped from the factory with a nitrogen holding charge. Remove the nitrogen holding charge using the Schrader valves located on the internal refrigerant piping.

Caution: Improperly installed piping may result in improper operation and possible damage to the cooling unit or surrounding equipment.

Ensure that the:

❑	Fans are turning freely and the blades are not distorted or bent.
❑	Condensate drain line is at least the size of the drain connection.
❑	Piping has been leak tested and held a vacuum prior to intorduction to refrigerant into the system..
❑	Mechanical connections are tight, including compressor and receiver rotolock connections.
❑	Refrigerant piping size is correct according to the line size table in the installation manual.
❑	The vertical, horizontal, and total run lengths of the liquid, dischanrge, and suction lines are recorded.
❑	The number of 45- and 90-degree bends in the refrigerant piping are recorded.
❑	Field-installed traps and piping are in accordance with the installation manual and follow proper piping practices.
❑	Piping is adequately supported and isolated when necessary.
❑	Field-installed service valves are open.
❑	Pressure relief valve is installed in accordance with the installation manual as well as local and national codes and regulations.
❑	Piping in the building and on the roof is properly insulated.
❑	Covers and guards are in place.

User Interface Inspection Checklist

The user interface inspection verifies that the sensors and internal communication links are installed properly. Check that the outdoor heat exchanger is connected to the cooling unit and to the other cooling units in the room if you are using cooling group controls.

Ensure that:

❑	An A-Link bus is connected to each cooling unit and a terminator is plugged into all unused A-Link connectors.
❑	The input contacts and output relays are connected correctly.
❑	The building management system is connected correctly and a terminator is wired into the final InRow RD between Modbus D0 and Modbus D1.
❑	The temperature and humidity sensors located on the front of the cooling unit are connected correctly.
❑	The rack temperature sensors are installed correctly.
❑	The network port is connected correctly and an IP address has been assigned to the equipment.
❑	The optional rope water detection device is installed properly.

Start-up Inspection Checklist

The start-up inspection ensures that the equipment is operating properly after the initial start-up. This inspection verifies that all modes of operation are working correctly and that the cooling unit is ready for normal operation.

Electrical Hazard: Perform Lockout/Tagout procedures on the cooling unit before servicing. Failure to remove power before servicing this equipment could result in serious injury or death.

Electrical Hazard: This equipment may have multiple power sources. Disconnect all power sources before performing any electrical or mechanical service.

Electrical Hazard: Measuring current draw exposes hazardous voltages. Use care when making these measurements. Wear personal protective equipment when working around hazardous voltages.

While the equipment is operating, ensure that:

❑	The sight glass moisture sensor is green.
❑	The current draw of fan motors, compressor, and transformers for the cooling operation is within the ratings of the respective circuit breakers. 1. Record the current at the main power connection of the main circuit breaker. 2. Record all current draws on the load side of any circuit breakers used for each device. 3. Compare the circuit breaker setting for each device to the actual current measured and the full load amps of the device to verify that the current draws are acceptable.
❑	Compressor suction and discharge pressures are recorded.
❑	The cooling unit has the proper refrigerant charge for year-round operation
❑	The cooling unit is free from malfunctions, including leaks, unusual vibrations, or other irregularities, in each mode of operation.
❑	The high-pressure switch is operating correctly. 1. Shut down the condenser. 2. The head-pressure will rise until the high-pressure switch shuts down the compressor. 3. Recort the shut-off point.
❑	The cool cycle engages.
❑	Air filters are clean and free of debris. Replace air filters with APC air filters only. (APC part number W875-201)
❑	The clogged filter alarm is operating properly. Cover 1/3 of the filter area to initiate the alarm.

Final Inspection Checklist

The final inspection verifies that the system is clean, the installed options work properly, and the start-up form is sent to APC.

Ensure that:

❑	The system is clean and free of debris.
❑	Packaging materials are disposed of properly.
❑	The start-up form was completed and sent to APC.

Charging With Refrigerant

Calculating R407C charge

Use the following table and formula when calculating the total R407C charge.

Condenser model	APC SKU	Selected ambient temp. in °C (°F)	Condenser summer charge in kg (lb)	Condenser flooded charge in kg (lb) for different minimum outdoor ambient temperatures				
				4°C (40°F)	-7°C (20°F)	-18°C (0°F)	-29°C (-20°F)	-40°C (-40°F)
LNE-S01-A009	ACCD75201 ACCD75204	35 (95)	4.5 (10)	9.7 (21.3)	10.7 (23.5)	11.2 (24.7)	11.6 (25.6)	12.7 (28.0)
LNE-S02-A015	ACCD75202 ACCD75205	40 (105)	6.8 (15)	14.2 (31.2)	15.6 (34.3)	16.4 (36.1)	17.0 (37.4)	18.6 (41.0)
LNE-S03-A027	ACCD75203 ACCD75206	46 (115)	13.6 (30)	28.0 (61.8)	30.8 (68.0)	32.4 (71.5)	33.6 (74.1)	36.8 (81.2)
KH1180.BDVES	ACCD75207	35 (95)	5.0 (11)	10.8 (23.7)	11.8 (26.1)	12.5 (27.5)	12.9 (28.5)	14.1 (31.2)
KH1280.ADVES	ACCD75208	40 (105)	6.8 (15)	14.4 (31.7)	15.8 (34.8)	16.6 (36.6)	17.2 (38.0)	18.9 (41.6)
KH1280.CDVES	ACCD75209	46 (115)	13.6 (30)	28.7 (63.3)	31.6 (69.6)	33.2 (73.3)	34.5 (76.0)	37.7 (83.2)

Total charge = Equipment charge + condenser summer charge + condenser flooded charge (for minimum possible ambient temperature) + liquid R407C in liquid pipe

Equipment charge: 9 kg (20 lb)

Quantity of R407C in 7/8 in OD liquid line: (area) x (length in ft) x (density): 0.00306 (ft^2) x L (ft) x 66.0 (lbm/ft^3)

Density of liquid R407C at 40.6°C (105°F) and 17.9 bar (260 psig): 1.057 g/cm^3 (66.0 lbm/ft^3)

Inside diameter of ACR copper tube (7/8 in OD): 19 mm (0.75-in)

Cross sectional area for 0.75 in inside diameter pipe is 0.000284 m^2 (0.00306 ft^2)

Liquid line charge for 7/8 in ACR copper tube: 0.32 kg/m (0.22 lb/ft)

Quantity of R407C in 3/4 in OD liquid line: (area) x (length in ft) x (density): 0.00245 (ft^2) x L (ft) x 66.0 (lbm/ft^3)

Density of liquid R407C at 40.6°C (105°F) and 17.9 bar (260 psig): 1.057 g/cm^3 (66.0 lbm/ft^3)

Inside diameter of ACR copper tube (3/4 in OD): 17 mm (0.67-in)

Cross sectional area for 17 mm (0.67 in) inside diameter pipe is 0.000227 m^2 (0.00245 ft^2)

Liquid line charge for 3/4 in ACR copper tube: 0.23 kg/m (0.16 lb/ft)

Example: Calculate the total R407C charge for an LNE-S01-A009 condenser with 25 ft of 7/8-in liquid piping. Minimum outdoor design temperature is -28.9°C (-20°F).

Note: Imperial units are used in this example.

Total R407C charge: 20 + 10 + 25.6 + (25*0.20) = 60.6 lb.

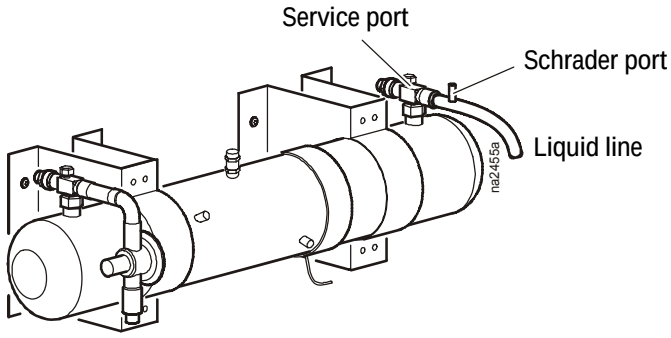
Charging the equipment

Caution: This procedure is to be done by APC-trained personnel only.

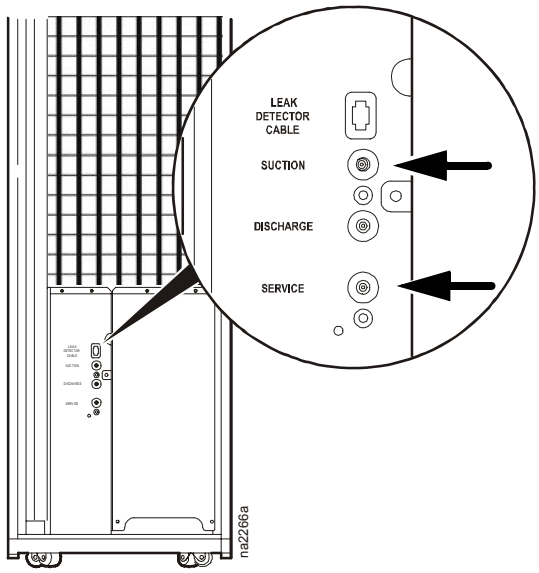
R407C is a blend refrigerant. When charging equipment with blend refrigerants, only liquid refrigerant must be charged.

Caution: Charging with other than liquid R407C refrigerant may damage the system.

1. Ensure the ball valves are open.
2. Confirm the calculated system charge.
3. Connect the refrigerant cylinder to the charging or gauge port on the receiver outlet valve. Open the receiver valve approximately half way.



4. Charge liquid refrigerant into the high side of the system until the system pressures equalize. While the unit is NOT operational, charge liquid to the suction (low side) line to simply equalize pressures throughout the system DO NOT start the system until the pressure equalizes. Please note charging liquid to the suction port during operation may damage or reduce the life of the compressor.
5. Prior to starting the system, make sure all system valves are open and the system high side pressure remains above 15.9 bar (230 psi). This may require blocking the condenser inlet slightly. Remove any blocking panels after charging is complete.
6. Start the cooling unit. See “Start the cooling unit” on page 18
7. Once the system is operational, front seat the receiver service valve and continue charging liquid at the Schrader port down stream of the receiver shutoff valve, until the calculated charge is complete. When this procedure is complete, fully back seat the receiver shutoff valve. Leave charging hoses in place in the event additional charging is required.



8. Charge the rest of the calculated liquid refrigerant very slowly through the suction port.

Caution: Fast charge of liquid refrigerant through the suction port may damage the compressor.

9. Verify that the sightglass is clear. If there is excessive bubbling in the sightglass, make sure the system high side pressure is above 15.9 bar (230 psi) and Superheat and Subcooling are within parameters (10-12 for Superheat and 8-10 for Subcooling). If additional charging is required, front seat the receiver outlet shutoff valve and weigh in the additional charge at the Schrader port.

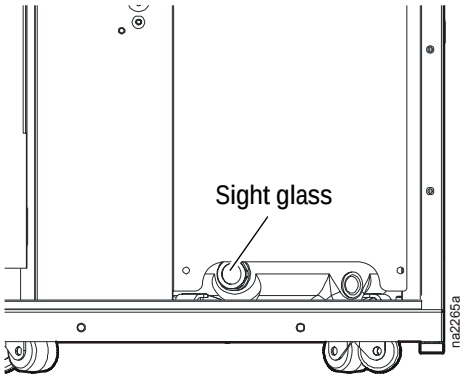
Note: Since good performance during low ambient temperatures depends on proper refrigerant charge, it is very important that this phase of the installation procedure be done carefully. Poor system preformance can be due to too little or too much charge.

Compressor Oil Charge

Caution: This procedure is to be done by APC-trained personnel only.

You may need to add oil to air-cooled equipment, depending on the condenser size and the lengths of tube running between the equipment and the condenser.

Let the compressor run at full capacity for at least one hour and check the oil level in the oil sight glass. The level should be between 1/4 and 3/4 full, or within the limit shown on the oil level sticker. If the oil is not within the acceptable limit, perform the oil-charging procedure below.



Caution: Do not charge the compressor with too much oil, or compressor damage could result. The only way to drain oil from the compressor is to remove the compressor from the equipment, which cannot be done when the equipment is in the row.

Oil charging procedure

1. Calculate the approximate amount of additional oil needed using the following formula:

   (**R** x 0.022 x 16)–(**C** x 0.10) = **A**

   – **R** — Refrigerant in the system (this amount should have been recorded during installation)
   – **C** — Compressor oil charge (in fluid ounces)
   – **A** — Amount of additional oil (in fluid ounces).

   Note: The compressor used in this equipment comes with an internal oil charge of 1686 ml (57 fl oz).

   In the following example, there are 50 pounds of refrigerant in the system.

   (**50** x 0.022 x 16)–(**57** x 0.10)
   (17.6)–(5.7) = 11.9 fluid ounces of additional oil

2. Prepare to add oil:

   a. Use a new, sealed oil can and a manual oil pump. The pump hose must be sized for 1/4 in flare fittings and must include a valve depressor at its end, which will open the valve on the Schrader service port of the compressor.

   b. At a minimum, use a quality POE oil with a viscosity of 32 cst, 160 sus at 40°C (104°F). Suggested oils: Danfoss Maneurop 160 PZ Polyolesteroil, the approved type of oil for this equipment. Approved alternative oil types:

   - CPI (Lubrizol) reference: CP-2931AH or CP-2931A or equivalent
   - ICI_UNIQUEMA reference: Emkarate RL32H or equivalent

3. Purge the pump and hose:
    a. Ensure that the oil pump is clean. Insert the pump in the oil container and make sure that the container is open to the atmosphere for as short a period of time as possible. When available, use a plug adaptor kit to further reduce the exposure of the oil to the atmosphere.
    b. Bleed all air from the pump and hose with a few strokes of the pump. Purging the pump removes the moisture-saturated oil left inside the hose from previous usage.
    c. Connect the hose to the Schrader service port of the compressor immediately after purging to avoid moisture contamination.
4. While the equipment is running, charge the oil through the suction service port. Pump the oil very slowly.
5. Allow the compressor to run at full capacity for at least one hour after charging the oil, then re-check the oil level in the sight glass. The level should be between 1/4 and 3/4 full, or within the limit shown on the oil level sticker.

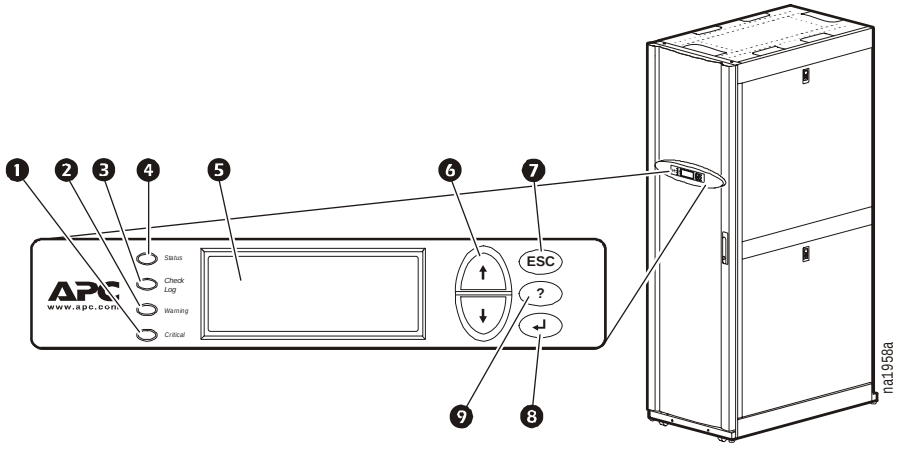
Caution: Be careful not to charge more oil than is necessary. Excessive oil in the system may cause system damage, including the following:

- Failure of valves and pistons due to oil slugging.
- Excessive oil carryover.
- Loss of evaporator performance due to oil level build-up in the low-pressure side of the system.

Note: Dispose of the oil waste appropriately.

Operation

Display Interface



Item		Function
1	Critical Alarm LED (red)	When lit, a critical alarm condition exists and requires your immediate attention.
2	Warning Alarm LED (yellow)	When lit, a warning alarm condition exists. Failure to correct this condition could cause a critical alarm.
3	Check Log LED (yellow)	When lit, at least one new event has been logged since the last time the log was checked. Only events that pertain to the operation of the cooling unit will activate the LED.
4	Status LED (green)	When lit, the cooling unit is receiving electrical power. When flashing green, the Cooling Unit is downloading firmware for the controller. This takes about one minute.
5	Liquid Crystal Display (LCD)	View alarms, status data, and context-sensitive help, and modify configurable items.
6	Up and down arrow keys	Select menu items and access information.
7	ESC key	Return to previous screen or cancel current operation.
8	Enter key	Open menu items and input changes to cooling group level and cooling unit level settings.
9	Help key	Display context-sensitive help. Press the help key for information about each option on the screen and for instructions on performing tasks.

Using the Display

Every time you apply power to the cooling unit, the display interface initializes, causing the LEDs to cycle and the alarm-tone to activate.

Scrolling status screens

After start-up, the interface displays the firmware revision number of the display interface. The display interface then scrolls automatically and continuously through screens of status information.

Status Screen Name	Status Information Displayed
InRow RD	• On/Standby • Unit identifier • Cooling Unit name • Cooling Unit location
Group	• Alarms/No Alarms • Cool Outpt (Cool Output) kW • Cool Setpt (Cool Setpoint) °C (or °F) • Max Rack *(Maximum Rack Temperature) °C (or °F)
Unit	• Alarms/No Alarms • Cool Output kW • Max Rack In (Max Rack Inlet) °C (or °F) • Air Flow l/s (liters per second) or CFM (cubic feet per minute)

Press the up or down arrow key to interrupt the automatic scrolling and view a specific status screen. To return to the scrolling status screens, press ESC from one of the main menu screens.

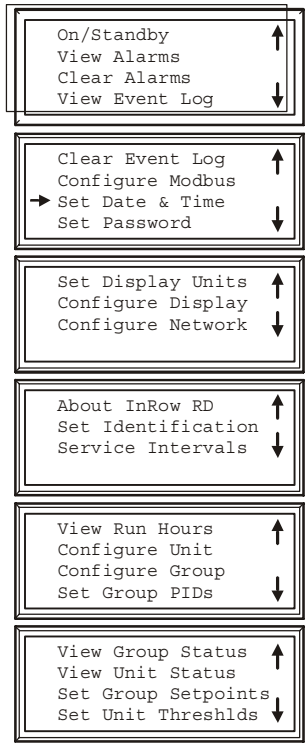
Main menu screens

On any top-level status screen, press the ENTER or ESC key to open the first main menu screen.

Note: Once a period of inactivity (at the keys of the display interface) exceeds the **Password Timeout** setting, the display interface returns to the scrolling status screens.

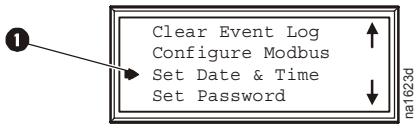
For information on setting the time-out duration, see "Timeout" on page 26.

All main menu choices are displayed on a series of six main menu screens, as shown.



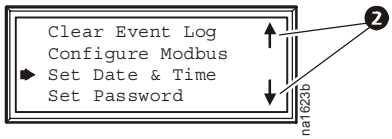
Navigating the main menu

Selector arrow. Press the up or down arrow key to move the selector arrow ❶ to a main menu option. Press the ENTER key to view the selected sub-menu screen. In the example shown below, the selector arrow points to the **Set Date and Time** setting. To select that item, press the ENTER key.



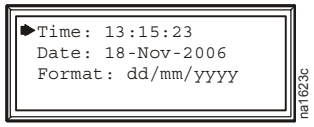
Note: If the selector arrow is on the top line of a main menu screen, press the up arrow key to move the selector arrow to the top line of the previous screen.

Continue arrows. Continue arrows ❷ indicate that additional options or settings are available on a menu or status screen. Press the up or down arrow key to view the additional items.



Sub-menus

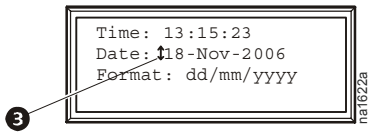
Selecting a main menu option displays the sub-menu screen for that option. In this example, the selector arrow is on the top line of the **Set Date and Time** sub-menu screen.



Use the up or down arrow key to move the selector arrow to an option, and press the ENTER key.

- **List of choices**. If the setting is a list of choices, an input arrow ❸ displays next to the setting. Press the up or down arrow key to select the menu option to change. Then press the ENTER key to exit the input mode and save the setting. Press the ESC key to exit without saving.
- **Numbers or text fields**. If the setting is a number or text field, use the arrow keys to select the value of the first character, and press the ENTER key to move to the next character. Press the ENTER key after the last character is set to exit the input mode and save the setting. Press the ESC key to exit without saving. If an invalid value is entered, the display interface beeps and restores the previous valid value to the field.

Input arrows. Input arrows ❸ next to a selected setting indicate that the setting can be modified by pressing the up or down arrow key. Press the ENTER key to save the change or the ESC key to cancel the change.



Using the Path statement

Select the main- and sub-menu options specified in the path statement to view or configure a setting. The path statement lists the main- and sub-menu items you select to navigate to the item to view or modify. The parts of the path statement are defined below:

Path: Main > Set Password >Change Passwords

Main >Your starting point is the main menu.

Set Password > Scroll to and select this option from the main menu.

Change Passwords > Scroll to and select this option from the sub-menu.

Subsequent options are listed and defined under the path statement.

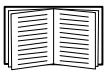
Password entry

The cooling unit has two levels of password protection:

- **Device password** allows Device Users to change basic and environmental settings.
- **Admin password** allows all privileges granted for Device Users, and also allows the Administrator to modify settings that control the components in the cooling unit or change advanced options.

When you try to change a setting, the display interface prompts you to enter your Admin password. The default value for both the Device and Admin password is **apc** (lowercase). To enter your password, use the up or down arrow key to scroll through the available character set. Press the ENTER key to select the current character and move the cursor to the next character position. After selecting the last character of your password, press the ENTER key once more to submit your password.

Once the password is entered, it remains in effect until the period of inactivity exceeds the **Password Timeout** setting.



See “Password and timeout” on page 26.

Note: Passwords are case-sensitive.

Start the cooling unit

Path: Main > On/Standby

To start the cooling unit, change the setting to **On** by pressing the ENTER key to toggle from **Standby** to **On**. At that point, the fans will start.

The cooling unit will run according to the configured settings.

Note: On/Standby only affects the local cooling unit. You must set the **On/Standby** option for each cooling unit in the cooling group.
Note: To toggle between **On** and **Standby** from the scrolling status screens, press the ENTER key three times in rapid succession.

Stop the cooling unit

Path: Main > On/Standby

Press the ENTER key to change the setting to **Standby**. The cooling unit will enter the standby mode.

Electrical Hazard: The **Standby** option does not remove power from the cooling unit. You must disconnect power at the mains to remove power from the cooling unit.

General Configuration

The cooling group configuration options are set during the commissioning of the cooling units in the cooling group.

Caution: This procedure is to be performed by APC authorized personnel only. Changing the settings incorrectly can cause malfunctions to your cooling unit.

Cooling unit configuration

Path: Main > Configure Unit > General

Capacity. Set the cooling capacity of the cooling unit:

- **Auto**: The cooling unit automatically controls its output under normal (default) conditions.
- **Max**: The cooling unit runs at full capacity.

Note: Normal checks for cooling failures are disabled in the **Max** mode.

Start-up Dly. Enter a value for the delay. The start-up delay begins when the cooling unit is started and initialized. The cooling unit cannot begin operation until this delay expires. Use the start-up delay to restart equipment sequentially in your room after a scheduled downtime or a power outage.

Idle On Leak. When set to **Yes**, the cooling unit will enter idle mode if a Water Detection Fault activates. Set to **No** to disable the cooling unit from entering idle mode if a leak is detected.

Note: The leak sensor (APC part number AP9325) is optional.

Note: There are three alarms that will cause the cooling unit to enter idle mode:

- Water Detection Fault (when **Idle On Leak** is set to **Yes**)
- Condensate Pump Fault
- Cooling Failure

See “Alarm messages and suggested actions” on page 32 for more information on alarms.

Contacts

View the state of Input and output contacts

Path: Main > Configure Unit > Discrete I/O

Each cooling unit supports a user-defined input contact and a user-defined output contact. Each contact monitors a sensor and responds to changes in the state of the sensor (open or closed).

Input State. Indicates the actual state of the input contact (open or closed). A cooling unit is **On** when the state is normal and in **Standby** when the state is not normal.

Output State. Indicates the actual state of the output contact (open or closed). An alarm will cause the output contact to change from the normal state.

Edit the normal state of input and output contacts

Path: Main > Configure Unit > Discrete I/O > Normal State

You can set input contacts to cause alarm conditions based on a user-defined normal state. Output contacts can map internal alarms and events to outside devices.

Input Norm. Set the normal state of the contact (open or closed). The cooling unit changes its operating mode to **Standby** when the actual state differs from the normal state.

Output Norm. Set the normal state of the contact (open or closed). If the state of an alarm or event mapped to this contact changes from the normal state, the contact also changes state.

Outpt Src. Define the type of output source (alarm), either **Any Alrm** or **Critical**, that causes the output to change from its normal state.

Cooling Group Configuration

The cooling group configuration settings determine which components are available and how the cooling group should operate.

Caution: This procedure is to be performed by APC authorized personnel only. The settings in the **Cooling Group Configuration** menu are defined by APC authorized personnel when the cooling group is commissioned.

Configure the cooling group

Path: Main > Configure Group

The **Configure Group** menu contains settings that identify the number of cooling units installed in this cooling group and the physical arrangement of those cooling units.

Num Units. Enter the number of cooling units in this cooling group. Up to 12 cooling units can be joined together to work as a single cooling group.

Type. Set the rack deployment strategy for the cooling units of this cooling group.

- **In-Row**: Air flow is not ducted. Hot aisle air is cooled, then shared by all loads in the row.
- **RACS**: (Rack Air Containment System). Air flow in the enclosure is controlled by a ducting system fitted to the enclosure.
- **HACS**: (Hot Aisle Containment System). Air flow in the room is controlled by enclosing the hot air aisle. The loads share an enclosed common hot aisle.

Identify the cooling unit

Path: Main > Set Identification

The **Set Identification** menu contains settings that identify the name and location of the cooling unit.

Unit Id. Assign a unique identification number to this cooling unit. Range: 1 through 12.

Name. Assign a **Name,** up to 40 alpha-numeric characters, of the cooling unit..

Location. Enter the **Location**, up to 40 alpha-numeric characters, of the cooling unit..

Note: Only the first 19 characters (of the 40 that are possible to enter) will display on the display interface. You must use Telnet, the Control console or the Web to access all 40 characters. See page 40 and page 38 for more information.

Configure Modbus

Path: Main > Configure Modbus

Use the **Configure Modbus** menu to set up communications between the cooling unit and the building management system.

Modbus. Enable or disable Modbus communication protocol.

Target Id. Each Modbus device must have a unique target identification number. Enter a unique number for this cooling unit.

Baud Rate. Set either 9600 bps or 19200 bps.

Fixed settings: 8 data bits, no parity, 1 stop bit. These settings cannot be modified.

Control the Environment

The primary function of the cooling unit is to cool air from the hot aisle and deliver it to the cold aisle at the temperature setpoint. The control strategies employed by the cooling unit depend upon the deployment strategy of the cooling group.

In an InRow environment, the cooling unit supplies constant-temperature supply air to the common cold aisle. The fan speed is modulated to ensure that the desired volume of air reaches the IT equipment. The fan speed is determined by the difference between the cooling setpoint and the maximum rack air inlet temperature.

In a HACS or RACS environment, the cooling unit neutralizes the heat accumulated in the common hot aisle and expels it back into the surrounding environmental space while maintaining the desired temperature in the cold aisle.

How the Cool mode works

Cool. The equipment uses a direct expansion coil, a variable speed compressor to modulate refrigerant flow through the coil, and a set of fans to control airflow through the coil. The cooling output is determined by the difference between the cooling setpoint and the supply air temperature of all the cooling units in the cooling group (if more than one cooling unit is present).

The cooling unit is equipped with compressor cycling control that tries to minimize the number of times the compressor cycles on and off. The compressor will cycle off when the rack inlet temperature drops below 15° C (59° F) whether or not the minimum compressor on time of 3 minutes has elapsed. Once off, the compressor will not normally cycle on until the supply temperature reaches its setpoint and the minimum off time of 2 minutes has elapsed. However, if the rack inlet temperature reaches 25° C (78° F), the compressor will cycle on regardless of whether the minimum off time has elapsed.

Compressor cycles are monitored over a 7-day period. If the number of cycles average more than 12 per hour over that period, the Excessive Compressor Cycling alarm is set.

See **Supply Air** and **Return Air** on page 29 for more information.

Setpoints

Path: Main > Set Group Setpoints

A setpoint is the target value that a cooling group tries to maintain in the rack. The default setpoints are appropriate for most cooling applications.

The setpoints for each mode must be within the following ranges:

- **Cool**: 18.0–25.0°C (64.4–77.0°F)
- **Supply Air**: 17.0–23.0°C (62.6–73.4°F)

Note: The Supply Air setting is defined by APC authorized personnel only when the cooling group is commissioned.
Note: If the **Supply Air** setpoint is greater than the **Cool** setpoint, the cooling unit triggers an alarm and resets the **Supply Air** setpoint to equal the **Cool** setpoint.

- **Fan Spd:** .Set the fan speed preference that will give you the desired temperature difference (DT). Each fan speed provides an approximate DT between the supply air from the equipment and the air returned from the rack.
  - Low = 16.7°C (30°F) DT
  - Med-Low = 13.9°C (25°F) DT
  - Med = 11.1°C (20°F) DT
  - Med-High = 6.3°C (15°F) DT
  - High = 5.6°C (10°F) DT

Note: The cooling group will automatically override this fan speed setting and adjust the fan speed to provide optimum cooling for the environment as needed.

PID settings

Path: Main > Set Group PIDs

The Proportional plus Integral plus Derivative (PID) loop controls the output of the fans.

Caution: This procedure is to be performed by APC authorized personnel only. Improperly set PID controls could result in equipment damage.

Gain (P). The proportional multiplier (gain) for this mode or actuator. The proportional multiplier adjusts for the difference (error) between the measured value and the setpoint.

Rate (I). The integral multiplier (reset rate) for this mode or actuator. The integral multiplier adjusts for error measurement and the amount of time that the error has existed. The integral multiplier adds to or subtracts from the output in small increments to correct for the offset error caused by the proportional contribution.

Deriv (D). The derivative multiplier (derivative) for this mode or actuator. The derivative multiplier adjusts the output for rapid changes in the error, correcting for the rate of change of the error over time.

Tune the PID loop

Tune the PID loop to optimize the performance of the cooling group.

Caution: This procedure must be performed by APC authorized personnel only. The PID loop must be tuned after the equipment in the room is installed and running. The loop should be tuned periodically to account for changes in the room load.

1. Adjust the integral and derivative constants to zero and the proportional constant to 1.0.
2. Set the temperature setpoint value and start the cooling group.
3. When the temperature reaches a stable value, increase the proportional constant by 0.5. If the temperature does not respond to this change, adjust the setpoint.
4. Repeat step 3 until the temperature value starts to oscillate and the peak amplitude of the oscillations is constant.
5. Note the time, in minutes, between the peaks of the oscillations. This is the Ultimate Period, P_U.
6. Note the value of the proportional constant. This is the Ultimate Gain, G_U.
7. Compute the PID constants using the table below. Use the equations for that control method in the row to compute the values for each constant.

Control Method	Proportional	Integral	Derivative
P	$0.5*G_U$	–	–
P + I	$0.45*G_U$	$0.54*G_U/P_U$	–
P + I + D	$0.6*G_U$	$1.2*G_U/P_U$	$0.075*G_U*P_U$

8. Set each constant according to these calculations.

You may need to further tune the PID loop in the following ways to account for changes in the room load:

Loop Behavior	PID Tuning Correction
Slow response to temperature changes	Increase the proportional multiplier or increase the derivative multiplier.
Overcooling/undercooling after changes in the room load or changes in setpoint	Increase the derivative or the proportional multiplier.
Environmental temperature never reaches the setpoint	Increase the integral multiplier.
Overcooling/undercooling on constant room load	Decrease the integral multiplier.

Run hours

The cooling unit records the number of hours each of its components has operated. When a component is replaced, use the **Reset Run Hours** option to reset the run hours for the displayed component to zero.

Path: Main > View Run Hours

Components:

- **Air Filter**
  - Reset Run Hours

    Note: Replace air filters with APC air filters only.
- **Fans**
  - Fan Number
    - Reset Run Hours
- **Condensate Pump**
  - Reset Run Hours
- **Compressor**
  - Reset Run Hours

Thresholds

Set alarms to alert you to threshold violations.

Path: Main > Set Unit Threshlds

When the monitored input violates the unit threshold, an alarm will occur. Set thresholds for the following sensors:

- **Rack Inlet**: The temperature of the air entering the rack at the rack inlet sensor.
- **Supply Air**: The average temperature of the air output from the cooling unit, measured by the upper and lower supply air temperature sensors.
- **Return Air**: The temperature of the air entering the cooling unit at the temperature sensor.

Service intervals

Path: Main > Service Intervals

The service interval depends on environmental cleanliness. Each component interval setting has an alarm. If enabled, the alarm will sound when the component interval has elapsed. The alarm is cleared by selecting **Clear Alarms** in the main menu. Set the number of weeks to service the following:

- **Air Filter Interval:** The default is 18 weeks.
- **Compressor Interval:** The default is 52 weeks.
- **Condensate Pump Interval**: The default is 52 weeks.
- **Fan Interval:** The default is 52 weeks.

Note: The **Air Filter** interval alarm is enabled by default. The **Condensate Pump**, **Fan**, and **Compressor** interval alarms are disabled by default.

Display

Set display interface settings, including time and date, units, passwords, and time-out. You can also adjust the contrast, key click, beeper volume, and beep-on-alarm settings.

Password and timeout

Path: Main > Set Password

Note: The default user password is **apc** (lowercase). See “Password entry” on page 17 for more information on how to enter the password.

Change passwords. Set the Admin and Device passwords.

1. Move the selector arrow next to the **Change Passwords** option and press the ENTER key.
2. Select the password to change (either **Admin** or **Device**).
3. Enter a new password (up to 8 characters).
4. Press the ENTER key to confirm.

Timeout. Set the length of time which can elapse when no keys are pressed before the display interface returns to the scrolling screen status. The password must then be entered to regain access.

Invalidate. Override the password timeout and require password entry immediately.

Date and time

Path: Main > Set Date & Time

Set the time. Enter the correct time, and press the ENTER key. The **Time** is displayed on some status screens and is also used in the alarm and event logs to time-stamp events. **.**

Set the date. Enter the day, month, and year, and press the ENTER key. The **Date** is displayed on some status screens and is also used in the alarm and event logs to date-stamp events.

Set the format. Use the up or down arrow key to select the date **Format** setting.

- mm/dd/yyyy (11/16/2007) (Default)
- yyyy-mm-dd (2007-11-16)
- dd-mmm-yy (16-Nov-07)
- mmm-dd-yy (Nov-16-07)
- dd.mm.yyyy (16.11.2007)

Adjust display

Path: Main Menu >Configure Display

Contrast. Adjust the visibility of the screen text. Lower numbered settings provide darker text; higher numbers provide lighter text. Settings range from 0–7.

Key Click. Enable or disable an audible tone every time a key is pressed on the display interface.

Beeper Volume. Set the volume of the display interface alarm tone, and for the audible tone that sounds every time a key is pressed on the display interface.

Beep On Alarm. Set the cooling unit to sound an audible tone every 30 seconds when a new alarm occurs. Silence the audible tone by pressing any key on the display interface. When the alarm clears itself, the tone will stop on its own.

Display units

Path: Main Menu > Set Display Units

Set the units of measure for the cooling unit to either **US** or **Metric**.

Network Configuration

The cooling unit is shipped with a Network Management Card (NMC) that enables you to manage the cooling unit over your network. Configure the network settings for the equipment Network Management Card from the display interface. The management card allows remote control and configuration of the equipment.

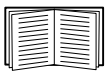
Configure the network

Path: Main > Configure Network

MAC Address. Displays the unique network identifier assigned to the Network Management Card of the cooling unit installed in the cooling unit at the factory.

Boot Mode. Set the method by which the Network Management Card of the cooling unit will acquire its network settings.

- **Manual:** Enter the IP Address, subnet mask, and default gateway using the **IP Address** menu.
- **BOOTP:** Set the Network Management Card of the cooling unit to obtain its network settings from a BOOTP server.
- **DHCP:** Set the Network Management Card of the cooling unit to obtain its network settings from a DHCP server.
- **BOOTPDHCP:** Set the Network Management Card of the cooling unit to search for its network settings from either a BOOTP or a DHCP server.



By default, DHCP requires an APC cookie before it will accept an IP address. See “DHCP” on page 36 for more information.

IP Address. You will be prompted to enter an Admin password. Enter the password and press ENTER to return to the **IP** screen. Press ENTER again to change the following settings for **Manual** boot mode only.

- **IP:** Enter the IP address assigned to the Network Management Card of the cooling unit.
- **SM:** Enter the subnet mask for the Network Management Card of the cooling unit.
- **GW:** Enter the default gateway for the Network Management Card of the cooling unit.

View Status Readings

The display interface has several options for viewing the status of the cooling unit, the cooling group to which the cooling unit belongs, and the environment being controlled. The status readings for the cooling unit are available under the **View Unit Status** option in the main menu, and status readings for the cooling group are available under the **View Group Status** option on the main menu or on the scrolling status screens.

Scrolling status screens

When the display interface is idle, it scrolls through screens of status information. Press the up or down arrow key to interrupt the automatic scrolling and view a specific status screen.

Cooling unit status

Path: Main > View Unit Status

View information specific to this cooling unit.

Op Mode. The cooling unit is in one of the following modes:

- **On**: The cooling unit is cooling.
- **Standby**: The cooling unit is receiving power but not enabled for cooling.
- **Idle**: The cooling unit is not operating in normal mode due to active alarms.

For more information, see “Idle On Leak” on page 19.

Cool Outpt. The actual cooling output of the cooling unit.

Cool Demnd. The amount of cooling that the heat load currently requires.

Supply Air. The average temperature of the air leaving the cooling unit, as measured by the upper and lower supply air temperature sensors.

Return Air. The temperature of the air entering the cooling unit.

Max Rack In. The highest reading of the three rack inlet temperature sensors determines the rack temperature.

Rack In #n. The temperature of the air entering the rack at the remote temperature sensor.

Air Flow. The amount of air required to maintain the setpoint temperature.

Fan Speed. The speed of the fans that regulate the air flow through the cooling unit.

Filter DP. The filter differential pressure.

Suct Pres (Suction Pressure). The pressure at the compressor inlet.

Disc Pres (Discharge Pressure). The pressure at the compressor outlet.

Compressor Drive: Speed. The compressor speed.

Compressor Drive: Power. The compressor power consumption.

Compressor Drive: Voltage. The compressor voltage.

Compressor Drive: Current. The compressor current draw.

Compressor Drive: DC Link. The compressor internal direct current (DC) link voltage.

Compressor Drive: Heat Sink. The compressor heat sink temperature.

Compressor Drive: Ctrl Card (Control Card). The compressor control card temperature.

Compressor Drive: Warn Stat. The compressor warning word used for diagnostics.

Compressor Drive: Alrm Stat. The compressor alarm word used for diagnostics.

Cooling group status

Path: Main > View Group Status

View information about the cooling group.

Cool Output. The combined output of the cooling group.

Cool Demand. The cooling output required to meet the current heat load of the conditioned space.

Cool Setpt. The temperature you set to maintain the room environment.

Max Rack. The highest rack temperature reported by any cooling unit in the cooling group.

Min Rack. The lowest rack temperature reported by any cooling unit in the cooling group.

Air Flow. The combined airflow output of the cooling units in the cooling group.

About the cooling unit

Path: Main > About InRow RD

View identifying information that is helpful when obtaining service:

- **Model**: Model number
- **S/N**: Serial number
- **F/W**: Display interface firmware revision
- **H/W**: Hardware revision
- **Made**: Date of manufacture
- **RP APP**: Application version
- **AOS Ver**: APC OS version

Event Log

The event log saves status information and a message each time a change in the cooling group is detected. Alarms and events are recorded in the log and displayed on the active alarms screen. Status events (informational) and system configuration changes are only displayed in the event log.

View event log

Path: Main > View Event Log

The event log keeps a record of all alarms and events. The screen displays the following:

- The name of the event.
- The time and date the event occurred.

Use the arrow keys to scroll through the list of events and display the date and time for each event.

Clear event log

Path: Main > Clear Event Log

A confirmation screen is displayed when you select this option. Enter the Admin password to erase the log. Select **YES** to erase all of the events in the log. Select **NO** to return to the main screen.

Respond to Alarms

When an alarm is triggered, the cooling unit alerts you through the display by the following methods:

- Active alarm screen entry on scrolling status screens
- LEDs on the front panel display
- An optional audible alarm every 30 seconds, if enabled

View active alarms

Path: Main > View Alarms

The **View Alarms** screen provides the number of alarms, the severity, and a brief description of the alarm. Press the arrow keys to view the rest of the list.

Clear active alarms

Path: Main > Clear Alarms

A confirmation screen is displayed when you select this option. Enter the Admin password to clear the alarm list. Select **YES** to clear all of the alarms in the list. Select **NO** to return to the main screen. If the conditions that caused the alarm still exist, those conditions cause the alarm to be regenerated.

Alarm messages and suggested actions

Alarm Message	Severity	Action Required
Air Containment Pressure Sensor Fault	Warning	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Air Filter Clogged	Warning	• Clean or replace the air filter. • If the problem persists, contact APC at a number listed on the back cover of this manual.
Air Filter Run Hours Violation	Warning	• Reset the Air Filter Run Hours after the air filter is cleaned or replaced.
A-Link Isolation Relay Fault	Critical	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Compressor Drive Communication Fault	Critical	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Compressor Drive Fault	Critical	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Compressor Drive Warning	Warning	• For assistance, contact APC at a number listed on the back cover of this manual.
Compressor High Pressure Alarm	Warning	• For assistance, contact APC at a number listed on the back cover of this manual.
Compressor Run Hours Violation	Warning	• At the display interface, make sure the **Compressor** run hours setting is correct in the **View Run Hours** screen after the appropriate maintenance for the device has been performed.
Condensate Pump Fault	Critical	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Condensate Pump Run Hours Violation	Warning	• At the display interface, reset the **Condensate Pump** run hours in the **View Run Hours** screen after the appropriate maintenance for the device has been performed.
Cooling Failure	Critical	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Discharge Pressure Sensor Fault	Warning	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
External Communication Fault	Critical	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Fan #n Fault	Warning	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Fan #n Run Hours Violation	Warning	• At the display interface, reset the **Fans** run hours in the **View Run Hours** screen after the appropriate maintenance for the device has been performed.
Filter Sensor Fault	Warning	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Group Communication Lost	Warning	• Make sure the number of cooling units in the group is configured properly, and the A-Link connections between cooling units are correct. • Make sure the system is receiving power and is connected properly. • If the problem persists, contact APC at a number listed on the back cover of this manual.

Alarm Message	Severity	Action Required
Persistant High Discharge Pressure Fault	Critical	• Indicates there were three **High Discharge Pressure** shutdowns in 30 minutes. Alarms must be cleared manually. • If the problem persists, contact APC at a number listed on the back cover of this manual.
High Suction Pressure Fault	Warning	• Check the air filter and evaporator for obstructions. • If the problem persists, contact APC at a number listed on the back cover of this manual.
Internal Communication Fault	Critical	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Low Suction Pressure Fault	Critical	• For assistance, contact APC at a number listed on the back cover of this manual.
On Standby: Input Contact Fault	Warning	• At the display interface, make sure the **Input Normal State** is defined correctly in the **Set Unit Threshlds** screen. • Clear the problem that caused the input contact switch to change from its normal state. • If the problem persists, contact APC at a number listed on the back cover of this manual.
Rack Inlet #n High Temperature Violation	Critical	• Make sure the temperature sensor is connected and placed properly. • Make sure the **Rack Inlet** threshold is set correctly in the **Set Unit Threshlds** screen. • If the problem persists, contact APC at a number listed on the back cover of this manual.
Rack Inlet #n Temperature Sensor Fault	Critical	• Make sure the sensors are connected properly. • If the problem persists, replace the sensor, or contact APC at a number listed on the back cover of this manual.
Return Air High Temperature Violation	Warning	• Make sure the **Return Air** threshold is set correctly in the **Set Unit Threshlds** screen. • If the problem persists, contact APC at a number listed on the back cover of this manual.
Return Air Sensor Fault	Critical	• Make sure the sensor is connected properly. • If the problem persists, replace the sensor, or contact APC at a number listed on the back cover of this manual.
Suction Pressure Sensor Failure	Warning	• A hardware failure exists. For assistance, contact APC at a number listed on the back cover of this manual.
Supply Air High Temperature Violation	Warning	• Make sure the temperature sensor is connected properly. • Make sure the **Supply Air** threshold is set correctly in the **Set Unit Threshlds** screen. • If the problem persists, contact APC at a number listed on the back cover of this manual.
Supply Air Sensor Fault (upper or lower)	Critical	• Make sure the faulty sensor is connected properly. • If the problem persists, replace the sensor, or contact APC at a number listed on the back cover of this manual.
Supply Humidity Sensor Fault	Critical	• Make sure the faulty sensor is connected properly. • If the problem persists, replace the sensor, or contact APC at a number listed on the back cover of this manual.
Water Detection Fault	Warning	• Identify the source of the leak. • For assistance, contact APC at a number listed on the back cover of this manual.

Network Management Card

Quick Configuration

The cooling unit is shipped with a Network Management Card that enables the cooling unit to be managed over a network. Configure the Network Management Card to control this cooling unit through a network.

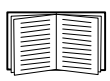
Overview

You must configure the following TCP/IP settings before the Network Management Card can operate on a network:

- IP address of the Network Management Card
- Subnet mask
- Default gateway

Caution: Never use the loopback address (127.0.0.1) as the default gateway address for the Network Management Card. Doing so will disable the card and will require you to reset TCP/IP settings to their defaults using a local serial login.

Note: If a default gateway is unavailable, use the IP address of a computer that is located on the same subnet as the Network Management Card and that is usually running. The Network Management Card uses the default gateway to test the network when traffic is very light.



See "Watchdog Features" in the "Introduction" of the *User's Guide* for more information about the watchdog role of the default gateway.

TCP/IP configuration methods

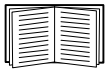
Use one of the following methods to define the TCP/IP settings needed by the Network Management Card:

- APC Device IP Configuration Wizard (See "APC Device IP Configuration Wizard" on this page.)
- BOOTP or DHCP server (See "BOOTP & DHCP configuration" on page 35.)
- Local computer (see "Local access to the control console" on page 36.)
- Networked computer (See "Remote access to the control console" on page 37.)

APC Device IP Configuration Wizard

You can use the APC Device IP Configuration Wizard at a computer running Windows 2000, Windows Server 2003, or Windows XP to configure a Network Management Card.

Note: Most software firewalls must be temporarily disabled for the Wizard to discover unconfigured Network Management Cards.



To configure one or more Network Management Cards from a user configuration file, see the *User's Guide* on the *Utility* CD.

1. Insert the *Utility* CD into a computer on your network.

2. If autorun is enabled, the user interface of the CD starts when you insert the CD. If autorun is not enabled, open the file **contents.htm** on the CD.

3. Select the Device IP Configuration Wizard from the main menu.
4. When the Wizard discovers the unconfigured Network Management Card, follow the on-screen instructions.

   Note: If you leave the **Start a Web browser when finished** option enabled, you can use **apc** for both the user name and password to access the Network Management Card through your browser.

.ini file utility

You can use the .ini file export utility to export .ini file settings from configured Network Management Cards to one or more unconfigured Network Management Cards. The utility and documentation are included on the *Utility* CD.

BOOTP & DHCP configuration

The default TCP/IP configuration setting, **BOOTP & DHCP**, assumes that a properly configured BOOTP or DHCP server is available to provide TCP/IP settings to Network Management Cards. The Network Management Card first attempts to discover a properly configured BOOTP server, and then a DHCP server. It repeats this pattern until it discovers a BOOTP or DHCP server.

If neither of these servers is available, see "Local access to the control console" on page 36, or "Remote access to the control console" on page 37 to configure the needed TCP/IP settings.

A user configuration (.ini) file can function as a BOOTP or DHCP boot file. For more information, see the TCP/IP configuration section of the *User's Guide*, available from the *Utility* CD or the APC Web site, **www.apc.com**.

BOOTP. For the Network Management Card to use a BOOTP server to configure its TCP/IP settings, it must find a properly configured RFC951-compliant BOOTP server.

1. In the BOOTPTAB file of the BOOTP server, enter the MAC address of the Network Management Card, and the IP addresses of the subnet mask, and default gateway, and an optional bootup file name. Look for the MAC address on the display interface (**Path: Main > Configure Network**) or on the label on the back of the Network Management Card.
2. When the Network Management Card reboots, the BOOTP server provides it with the TCP/IP settings.
   - If you specified a bootup file name, the Network Management Card attempts to transfer that file from the BOOTP server using TFTP or FTP. The Network Management Card assumes all settings specified in the bootup file.
   - If you did not specify a bootup file name, you can configure the other settings of the Network Management Card remotely through its Web interface or control console; user name and password are both **apc**, by default.

See your BOOTP server documentation to creat a bootup file.

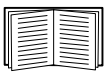
DHCP. You can use a RFC2131/RFC2132-compliant DHCP server to configure the TCP/IP settings for the Network Management Card.

This section summarizes communication between the Network Management Card and a DHCP server. For more detail about how a DHCP server can configure the network settings for a Network Management Card, see "DHCP Configuration" in the *User's Guide*.

1. A Network Management Card sends out a DHCP request that uses the following to identify itself:
   - A Vendor Class Identifier (APC by default)
   - A Client Identifier (by default, the MAC address value of the Network Management Card)
   - A User Class Identifier (by default, the identification of the application firmware of the Network Management Card)
2. A properly configured DHCP server responds with a DHCP offer that includes all of the settings that the Network Management Card needs for network communication. The DHCP offer also includes the Vendor Specific Information option (DHCP option 43). By default, the Network Management Card will ignore DHCP offers that do not encapsulate the APC cookie in the Vendor Specific Information option using the following hexadecimal format:

   ```
   Option 43 = 01 04 31 41 50 43
   ```

   where
   - the first byte (`01`) is the code
   - the second byte (`04`) is the length
   - the remaining bytes (`31 41 50 43`) are the APC cookie

   See your DHCP server documentation to add code to the Vendor Specific Information option.

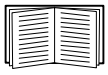
   To change the control console **DHCP Cookie Is** setting, use the **Advanced** option in the TCP/IP menu. See "Remote access to the control console" on page 37.

   To disable the requirement that a DHCP offer include the APC cookie, use the **DHCP Cookie Is** setting in the control console: **Network**>**TCP/IP**>**Boot Mode**>**DHCP only**>**Advanced**>**DHCP Cookie Is**.

Local access to the control console

You can use a computer connected to the serial port on the main board holding the Network Management Card to access the control console.

1. Select a serial port at the local computer, and disable any service that uses that port.
2. Use the configuration cable to connect the selected port to the serial port on the main board holding the Network Management Card. Use either 940-0103, the 6-ft (1.8-m) cable that came with your UPS, or AP9804 (990-1524), the 15-ft (4.6-m) cable available from APC.
3. Run a terminal program (such as HyperTerminal) and configure the selected port for 9600 or 19200 bps, 8 data bits, no parity, 1 stop bit, and no flow control. Save the changes.
4. Press ENTER to display the **User Name** prompt.
5. Use **apc** for the user name and password.



See "Control console" on page 38 to finish the configuration.

Remote access to the control console

From any computer on the same subnet as the Network Management Card, you can use ARP and Ping to assign an IP address to a Network Management Card, and then use Telnet to access the control console of that Network Management Card and configure the needed TCP/IP settings.

Note: After the IP address of the Network Management Card is configured, you can use Telnet without first using ARP and Ping to access that Network Management Card.

1. Use the MAC address for the Network Management Card in the ARP command to define the IP address. For example, to define an IP address of 156.205.14.141 for a Network Management Card that has a MAC address of 00 c0 b7 63 9f 67, use one of the following commands:

   – Windows command format:

   ```
   arp -s 156.205.14.141 00-c0-b7-63-9f-67
   ```

   – LINUX command format:

   ```
   arp -s 156.205.14.141 00:c0:b7:63:9f:67
   ```

   Note: The MAC address is available on the display interface at: **Path: Main > Configure Network** or look at the label on the back of the Network Management Card for the MAC address.

2. Use Ping with a size of 113 bytes to assign the IP address defined by the ARP command. For the IP address defined in step 1, use one of the following Ping commands:

   – Windows command format:

   ```
   ping 156.205.14.141 -l 113
   ```

   – LINUX command format:

   ```
   ping 156.205.14.141 -s 113
   ```

3. Use Telnet to access the Network Management Card at its newly assigned IP address. For example:

   ```
   telnet 156.205.14.141
   ```

4. Use **apc** for both user name and password.

See “Control console” on page 38 to finish the configuration.

Control console

After you log on at the control console, as described in“Local access to the control console” on page 36 or “Remote access to the control console” on page 37:

1. Choose **Network** from the **Control Console** menu.
2. Choose **TCP/IP** from the **Network** menu.
3. If you are not using a BOOTP or DHCP server to configure the TCP/IP settings, select the **Boot Mode** menu and then select **Manual boot mode**.
4. Set the **System IP**, **Subnet Mask,** and **Default Gateway** address values. (Changes will take effect when you log out.)
5. Press ENTER to return to the **TCP/IP** menu.
6. Press CTRL+C to exit to the **Control Console** menu.
7. Log out (option 4 in the **Control Console** menu).

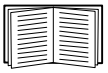
Note: If you disconnected a cable from the local computer during the procedure described in “Local access to the control console” on page 36, reconnect that cable and restart the associated service.

Access a Configured Network Management Card

Overview

After the Network Management Card is running on your network, you can access the configured Network Management Card through the following interfaces:

- Web interface (HTTP or HTTPS protocol)
- Telnet or Secure SHell (SSH)
- SNMP
- FTP or Secure CoPy (SCP) to upgrade firmware
- Modbus

 For more information on the interfaces, see the *User's Guide*.

Web interface

Use Microsoft® Internet Explorer® (IE) 5.5 and higher (on Windows® operating systems only), Mozilla-based browsers that support Firefox 1.*x* (on all operating systems), or Netscape® 7.*x* and higher (on all operating systems) to access the Web interface of the cooling unit. Other commonly available browsers also may work but have not been fully tested by APC.

You can use either of the following protocols when you use the Web interface:

- The HTTP protocol (enabled by default), which provides authentication by user name and password but no encryption.
- The HTTPS protocol, which provides extra security through Secure Sockets Layer (SSL); encrypts user names, passwords, and data being transmitted; and authenticates the Network Management Card by means of digital certificates.

To access the Web interface and configure the security of your device on the network:

1. Address the Network Management Card by its IP address or DNS name (if configured).
2. Enter the user name and password (by default, **apc** and **apc** for an Administrator).
3. To enable or disable the HTTP or HTTPS protocols, use the **Network** menu on the **Administration** tab, and select the **access** option under the **Web** heading on the left navigation menu.

For more information on selecting and configuring network security, see the *Security Handbook*, available on the *Utility* CD or from the APC Web site, **www.apc.com**.

Telnet and SSH

You can access the control console through Telnet or Secure SHell (SSH), depending on which is enabled. Select the **Administration** tab, the **Network** option on the top menu bar, and then the **access** option under **Console** on the left navigation menu. By default, Telnet is enabled. Enabling SSH automatically disables Telnet.

Telnet for basic access. Telnet provides the basic security of authentication by user name and password, but not the high-security benefits of encryption. To use Telnet to access the control console of the Network Management Card:

1. At a command prompt, use the following command line, and press ENTER:

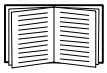
   `telnet address`

   As *address*, use the IP address of the Network Management Card or DNS name (if configured).

2. Enter the user name and password (by default, **apc** and **apc** for an Administrator, or **device** and **apc** for a Device User).

SSH for high-security access. If you use the high security of SSL for the Web interface, use Secure SHell (SSH) for access to the control console. SSH encrypts user names, passwords, and transmitted data.

The interface, user accounts, and user access rights are the same whether you access the control console through SSH or Telnet, but to use SSH, you must first configure SSH and have an SSH client program installed on your computer.



See the *User's Guide* for more information on configuring and using SSH.

Simple Network Management Protocol (SNMP)

SNMPv1 only. After you add the PowerNet® MIB to a standard SNMP MIB browser, you can use that browser to access the Network Management Card. All user names, passwords, and community names for SNMP are transferred over the network as plain text. The default read community name is **public**; the default read/write community name is **private**.

SNMPv3 only. For SNMP GETs, SETs, and trap receivers, SNMPv3 uses a system of user profiles to identify users. An SNMPv3 user must have a user profile assigned in the MIB software program to perform GETs and SETs, browse the MIB, and receive traps. The default settings are **no authentication** and **no privacy**.

Note: To use SNMPv3, you must have a MIB program that supports SNMPv3.

Note: The Network Management Card supports only MD5 authentication and DES encryption.

SNMPv1 and SNMPv3. To use InfraStruXure Central or InfraStruXure Manager to manage the Network Management Card, you must have SNMPv1 enabled in the unit interface. Read access allows InfraStruXure devices to receive traps. Write access is required while you set the InfraStruXure device as a trap receiver.

To enable or disable SNMP access, you must be an Administrator. Select the **Administration** tab, select the **Network** menu on the top menu bar, and use the **access** option under **SNMPv1** or **SNMPv3** on the left navigation menu.

FTP/SCP

You can use FTP (enabled by default) or Secure CoPy (SCP) to transfer downloaded firmware to the Network Management Card, or to access a copy of the event or data logs of the cooling unit. SCP provides the higher security of encrypted data transmission and is enabled automatically when you enable SSH.

To use InfraStruXure Manager to manage the Network Management Card, you must have the **FTP Server** enabled in the Network Management Card. To enable or disable **FTP Server** access, you must be an Administrator. On the **Administration** tab, select the **Network** menu on the top menu bar, and use the **FTP server** option on the left navigation menu.

In the *User's Guide*, see the following sections:

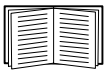
- To transfer firmware, see "File Transfers."
- To retrieve a copy of the event or data log, see "Use FTP or SCP to retrieve log files."

Modbus

Modbus lets you view the Network Management Card through the interface of your building management system.

The Modbus interface supports 2-wire RS-485, plus ground.

Note: Modbus can be configured to run at either 9600 or 19200 bps. It is already configured for 8 data bits, no parity, and 1 stop bit, which are not changeable.



To access the Modbus register map, go to the APC Web site, **www.apc.com**.

Recover From a Lost Password

You can use a local computer (a computer that connects to the Network Management Card through the serial port) to access the control console.

1. Select a serial port at the local computer, and disable any service that uses that port.
2. Connect the provided RS-232 configuration cable to the selected port on the computer and to the RS-232 console port at the Network Management Card.
3. Run a terminal program (such as HyperTerminal) on your computer and configure the selected port for 9600 bps, 8 data bits, no parity, 1 stop bit, and no flow control.
4. Press ENTER, repeatedly if necessary, to display the **User Name** prompt. If you are unable to display the **User Name** prompt, verify the following:
   - The serial port is not in use by another application.
   - The terminal settings are correct as specified in step 3.
   - The correct cable is being used as specified in step 2.
5. Press the **Reset** switch. The Status LED will flash alternately orange and green. Press the **Reset** button a second time immediately while the LED is flashing to reset the user name and password to their defaults temporarily.
6. Press ENTER as many times as necessary to redisplay the **User Name** prompt, then use the default, **apc,** for the user name and password. (If you take longer than 30 seconds to log on after the **User Name** prompt is redisplayed, you must repeat step 5 and log on again.)
7. From the **Control Console** menu, select **System**, then **User Manager**.
8. Select **Administrator**, and change the **User Name** and **Password** settings, both of which are now defined as **apc**.
9. Press CTRL+C, log off, reconnect any serial cable you disconnected, and restart any service you disabled.

Maintenance

Monthly Preventive Maintenance

Photocopy the following pages and use them during the maintenance procedures. After they have been completed, save them for future reference.

Prepared By: _____

Model Number: _____

Serial Number: _____

Date: _____

Environment

- ❑ In what type of room is the cooling unit located?

  _____

- ❑ Is the cooling unit maintaining the temperature setpoint?

  _____

  Temperature setpoint _____

- ❑ Is there visible damage to the cooling unit (dents, scratches)?

  _____
  _____
  _____

- ❑ Check for environmental damage (dirt, dust, debris, liquid stains) around the cooling unit installation area.

  _____
  _____

- ❑ Record the room temperature near the return of the cooling unit.

  Temperature _____

- ❑ Record the alarm history for the last month.

  _____
  _____
  _____

Cleanliness

- ❑ Check the condition of the air filters. Change if necessary.
- ❑ Check for accumulation of debris in the drain pan. Clean as required.

Mechanical

Electrical Hazard: Turn off the cooling unit and disconnect all power sources. Perform Lockout/ Tagout procedures before performing any electrical or mechanical service. Wear appropriate personal protective equipment when checking hazardous voltages.

- ❑ Check the fans. All components should be moving freely with no signs of binding or damages.
- ❑ Verify that the condensate line is flowing freely.

Electrical

Electrical Hazard: Turn off the cooling unit and disconnect all power sources. Perform Lockout/ Tagout procedures before performing any electrical or mechanical service. Wear appropriate personal protective equipment when checking hazardous voltages.

- ❑ Inspect the electrical panel for tight connections and overheated connections from loose contact terminals.
- ❑ Confirm the incoming main voltage matches the cooling unit nameplate. The measurement should be within 10% of the nameplate listing.

Quarterly Preventive Maintenance

* Perform all the Monthly Preventive Maintenance items **and** the items below.

Prepared By: _____

Model Number: _____

Serial Number: _____

Date: _____

Mechanical

Electrical Hazard: Turn off the cooling unit and disconnect all power sources. Perform Lockout/Tagout procedures before performing any electrical or mechanical service. Wear appropriate personal protective equipment when checking hazardous voltages.

- ❑ Verify that the fan hardware is tight.
- ❑ Clean the condensate drain line.
- ❑ Clean the dust from door perforations.
- ❑ Clean the dust from fan bezels.

Functional tests

- ❑ Verify the cooling operation mode is functioning properly.

Semi-Annual Preventive Maintenance

* Perform all the Monthly/Quarterly Preventive Maintenance items **and** the items below.

Prepared By: _____

Model Number: _____

Serial Number: _____

Date: _____

Cleanliness

- ❑ Check the cleanliness of the evaporator coil. Clean if required.

Troubleshooting

Problem	Possible Cause	Corrective Action
Controls erratic or inoperative	• Inlet temperature to cooling unit is higher than rated maximum temperature	• Reduce the load or add additional cooling equipment.
Fans fail to start	• Cooling unit shutdown due to an external command	• Temporarily remove the input contact cable, if it is connected.
	• Single fan fails to start	• Verify that the farn circuit breaker is ON.
Cooling unit cannot obtain setpoint	• Improper placement of remote temperature sensor	• Verify that the remote temperature sensor is properly located in the cold aisle.
	• Dirty filter	• Clean the filter.
	• Dirty coil	• Clean the coil.
	• Application error	• Contact APC at a number located on the rear of this manual.
	• Heat load is too far away	• Place the cooling unit closer to the heat load.
Water carryover	• Improper fan speed selected	• RACS and HACS modes only: Select the next-highest fan speed setting. For example, change the fan speed setting from Low to Med/Low.
	• Room humidity is too high/low	• Improve room sealing.
Temperature control not tight enough	• Improper placement of remote temperature sensor	• Verify that the remote temperature sensor is properly located in the cold aisle.
Water on outside of cooling unit	• Condensate drain hose is not connected or not properly routed outside the cooling unit	• Verify that the condensate drain hose is properly connected to the pump and properly routed outside of the cooling unit. • Verify that the condensate drain line does not exceed 3.5 m (11.5 ft) lift and 18.0 m (60.0 ft) horizontal run.
	• Leak in drain system	• Locate and repair the leak.
	• Cooling unit not leveled properly	• Adjust the leveling feet of the cooling unit.
	• Damaged piping insulation	• Identify damaged area and repair the insulation.
Display interface not operational, but cooling unit operates	• Display interface not connected properly	• Verify that the display interface cable is connected properly.
Incorrect air pressure	• False filter clogs	• Verify that the ends of the clear plastic air tubes are not obstructed. • Verify that the clear plastic air tubes are connected to the controller. • Verify that the clear plastic air tubes are not pinched.

Problem	Possible Cause	Corrective Action
Alarms do not show up on monitoring equipment (Customer Output Contact)	• External monitoring equipment is not receiving power or is not functioning properly	• Confirm that power, if required, is being supplied to the external equipment. • If the cooling unit (+12 V or +24 V) is providing power to the external equipment, verify that the external equipment is ≤50 mA. • Test the external equipment by bypassing the customer output contact. • Verify Customer Output Contact settings. See “Contacts” on page 20.
Cooling unit does not shut down on command	• Drive voltage	• Verify that there is a drive voltage entering the input of the cooling unit. You may use the available +12 V or +24 V. You must also use the ground. • Verify Customer Input Contact settings. See “Contacts” on page 20.
No communication with building management system (BMS) port	• Improper connection	• Confirm that the cooling unit is connected to the BMS port and not to the Control port. • Make sure that the wire polarity is correct. Using a DC voltmeter, test the signal with no transmissions in progress. Expect the voltage at pin 2 to be greater than at pin 1 by at least 200 mV. Measure the cooling unit with the cable disconnected, and then measure it again with the cable connected. If the signal is less than 200 mV, the cooling unit may be reverse-wired. • Make sure that every cooling unit has either two sets of wires in its connector or one set of wires and a terminating resistor of 100 to 120 ohms.
Cooling units are not communicating with each other	• A-Link failure	• Verify that the first and last cooling units have one cable and a terminator. • Verify that every other cooling unit has two cables. • Confirm that the A-Link cables are connected to the A-Link ports and that a network cable is connected to the network port. • Verify that the number of cooling units in the cooling group matches the group number setting.
Output air is 17° C (62° F) and fans are running at a very high rate of speed.	• Upper or lower supply air sensor	• Either upper or lower supply air temperature sensor has a fault. Verify that both supply air temperature sensors are installed and working properly.

Warranty

One-Year Factory Warranty

The limited warranty provided by American Power Conversion (APC®) in this Statement of Limited Factory Warranty applies only to products you purchase for your commercial or industrial use in the ordinary course of your business.

Terms of warranty

American Power Conversion warrants its products to be free from defects in materials and workmanship for a period of one year from the date of purchase. The obligation of APC under this warranty is limited to repairing or replacing, at its sole discretion, any such defective products. This warranty does not apply to equipment that has been damaged by accident, negligence or misapplication or has been altered or modified in any way. Repair or replacement of a defective product or part thereof does not extend the original warranty period. Any parts furnished under this warranty may be new or factory-remanufactured.

Non-transferable warranty

This warranty extends only to the original purchaser who must have properly registered the product. The product may be registered at the APC Web site, **www.apc.com**.

Exclusions

APC shall not be liable under the warranty if its testing and examination disclose that the alleged defect in the product does not exist or was caused by end user's or any third person's misuse, negligence, improper installation or testing. Further, APC shall not be liable under the warranty for unauthorized attempts to repair or modify wrong or inadequate electrical voltage or connection, inappropriate on-site operation conditions, corrosive atmosphere, repair, installation, start-up by non-APC designated personnel, a change in location or operating use, exposure to the elements, Acts of God, fire, theft, or installation contrary to APC recommendations or specifications or in any event if the APC serial number has been altered, defaced, or removed, or any other cause beyond the range of the intended use.

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NO SALESMAN, EMPLOYEE OR AGENT OF APC IS AUTHORIZED TO ADD TO OR VARY THE TERMS OF THIS WARRANTY. WARRANTY TERMS MAY BE MODIFIED, IF AT ALL, ONLY IN WRITING SIGNED BY AN APC OFFICER AND LEGAL DEPARTMENT.

Warranty claims

Customers with warranty claims issues may access the APC customer support network through the Support page of the APC Web site, **www.apc.com/support**. Select your country from the country selection pull-down menu at the top of the Web page. Select the Support tab to obtain contact information for customer support in your region.

Warranty Procedures

Claims

To obtain service under the warranty, contact APC Customer Support (see the back cover of this manual for contact information). You will need the model number of the Product, the serial number, and the date purchased. A technician will also ask you to describe the problem. If it is determined that the Product will need to be returned to APC, you must obtain a returned material authorization (RMA) number from APC Customer Support. Products that must be returned must have the RMA number marked on the outside of the package and must be returned with transportation charges prepaid. If it is determined by APC Customer Support that on-site repair of the Product is allowed, APC will arrange to have APC authorized service personnel dispatched to the Product location for repair or replacement, at the discretion of APC.

Parts

- APC warrants the parts of their systems for 1 year from the date of commissioning or 18 months from the ship date. This warranty only covers the cost of the part and not the labor for installation.
- Calls for warranty parts requests need to have specific unit information (serial number, model number, job number) to allow proper identification and processing of the warranty part transaction.
- A purchase order may be required to issue any warranty parts. An invoice will be sent once the parts are shipped to the field. You have 30 days to return the defective parts to APC. After 30 days, the warranty invoice will be outstanding, and payment of the invoice will be expected in full.
- Return authorization documentation will be sent with the replacement part. This documentation must be sent back with the defective part to APC for proper identification of the warranty return. Mark the warranty return number on the outside of the package.
- After the part has been received at APC, we will determine the status of the credit based on the findings of the returned part. Parts that are damaged from lack of maintenance, misapplication, improper installation, shipping damage, or acts of man/nature will not be covered under the parts warranty.
- Any warranty parts request received before 1:00 PM EST will be shipped same-day standard ground delivery. Any costs associated with Next Day or Airfreight will be the responsibility of the party requesting the part.
- Return freight of warranty parts to APC is the responsibility of the party returning the part.

APC Worldwide Customer Support

Customer support for this or any other APC product is available at no charge in any of the following ways:

- Visit the APC Web site to access documents in the APC Knowledge Base and to submit customer support requests.
  - **www.apc.com** (Corporate Headquarters)
    Connect to localized APC Web sites for specific countries, each of which provides customer support information.
  - **www.apc.com/support/**
    Global support searching APC Knowledge Base and using e-support.
- Contact an APC Customer Support center by telephone or e-mail.
  - Regional centers

Direct InfraStruXure Customer Support Line	(1)(877)537-0607 (toll free)
APC headquarters U.S., Canada	(1)(800)800-4272 (toll free)
Latin America	(1)(401)789-5735 (USA)
Europe, Middle East, Africa	(353)(91)702000 (Ireland)
Western Europe (inc. Scandinavia)	+800 0272 0272
Japan	(0) 3 6402-2001
Australia, New Zealand, South Pacific area	(61) (2) 9955 9366 (Australia)

  - Local, country-specific centers: go to **www.apc.com/support/contact** for contact information.

Contact the APC representative or other distributor from whom you purchased your APC product for information on how to obtain local customer support.

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